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OBSERVATIONS ON *SCARAPHITES ROTUNDIPENNIS* (DEJEAN) (COLEOPTERA: CARABIDAE) A PEST OF GOLF COURSES ON FLINDERS ISLAND

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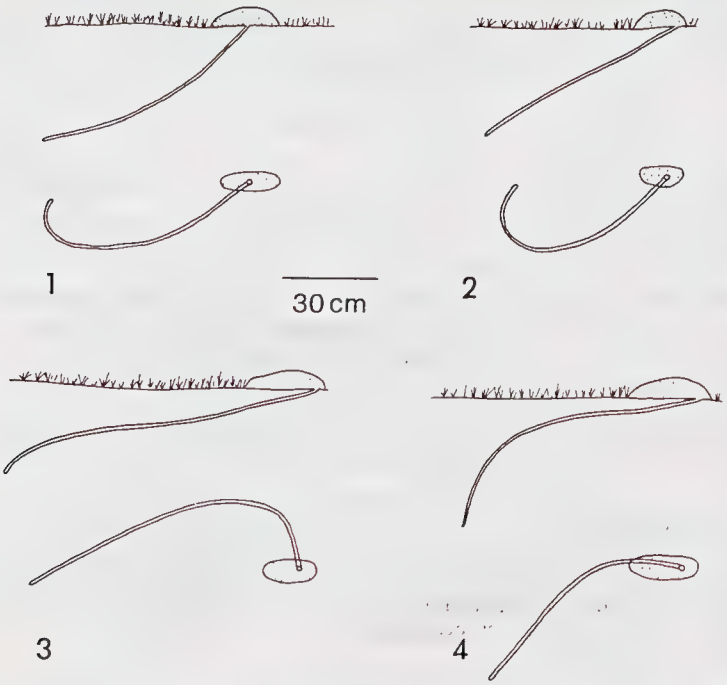
Abstract

On Flinders Island, adults of the carabid *Scaraphites rotundipennis* (Dejean) excavate extensive tunnels in search of the larvae of scarab beetles, especially the dynastine *Pimelopus* sp., and the melolonthines *Scitala sericans* Erichson and *Phyllotocus* sp., upon which they feed. Mounds of excavated soil thrown up by this tunnelling activity interfere with play on local golf courses. Some details are given of the feeding behaviour of the beetles.

Introduction

Little is known of the feeding habits of adult scaritine carabids in Australia (Britton, 1970). In May 1980, a population of the large flightless predatory beetle *Scaraphites rotundipennis* (Dejean) was located at Whitemark golfcourse on Flinders Island in Bass Strait after complaints from the greenkeeper regarding insect damage to greens and fairways. The opportunity was therefore taken to make both field and laboratory observations on the feeding behaviour of the beetles.

Flinders Island has a temperate maritime climate; mean annual rainfall at Pat's River near Whitemark is 778 mm with a mean annual minimum and maximum temperature of 9.4°C and 17.4°C respectively (Bureau of Meteorology, 1975). The Whitemark golfcourse is located behind coastal dunes on the S.W. margin of the Island. The soil is mainly deep, slightly calcareous sand of the Lackrana association (Dimmock, 1957) with little profile differentiation other than accumulation of organic matter to about 25 cm. Particle size range is about 68% coarse sand, 31% fine sand and 1% silt and clay (Graley, 1956). Soil-dwelling insects were most abundant in hollows adjacent to the fairways and areas near remnant patches of open coastal heath consisting of *Acacia sophorae, Leptospermum* spp. and *Leucopogon* sp. with an understorey of *Poa australis, Scirpus nodosus* and *Meuhlenbeckia* sp.



Figs 1-4. Burrows of four specimens of *Scaraphites rotundipennis* shown in profile (upper) and plan (lower), Whitemark Golfcourse, 30 May 1980.

Methods

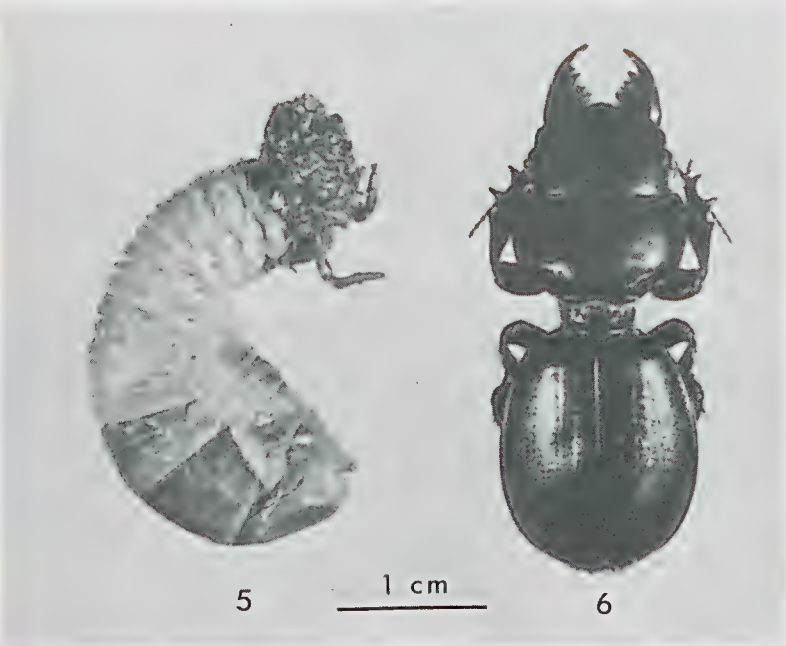
The density of burrows was measured by direct counting of soil mounds in areas 10 m x 10 m taken at random in areas of beetle activity. The entrance of a burrow was located by running a finger along the ground under its mound. Inserting a length of thin plastic tubing allowed the dimensions of the mound to be defined after careful excavation.

The density of other soil macrofauna was assessed by taking 30 random 0.25 square metre core samples to a depth of 25 cm and hand-sorting in the field.

The behaviour of four adult beetles was observed over five days in captivity by introducing solitary beetles into perspex observation boxes 45 cm x 30 cm x 2 cm containing soil from the collection site and 10 final instar larvae of the melolonthine *Scitala sericans* Erichson. Temperature was maintained at 22 ± 2°C.

Results

Burrows were irregularly distributed over the golf course and densities per 100 square metres ranged from 11-78 ($\bar{x} \pm SE = 38 \pm 7$; $n = 14$).



Figs 5,6. (5) a partially-eaten final instar larva of *Pimelopus* sp. recovered from a feeding burrow; (6) adult *Scaraphites rotundipennis* in death-feigning pose.

Beetles excavated deep burrows for shelter and in search of prey. The location of a burrow was marked by a large mound of excavated soil which, at Whitemark, interfered with golf. Burrows (Figs 1-4) were generally curved in plan, 70-100 cm long and descended obliquely to a depth of 30-35 cm.

Beetles were generally found in the lower 10 cm of the burrow although two were found in the upper 15 cm. Upon exposure the beetles adopted a death-feigning attitude (Fig. 6). Not all burrows were occupied; of 34 excavated, only eight, or 24% contained a beetle.

At least four species of third-instar scarabaeid larvae inhabited the area. In decreasing order of biomass these were the dynastine *Pimelopus* sp., the melolonthine *Scitala sericans* Erichson, the aphodiine *Aphodius tasmaniae* Hope and the melolonthine *Phyllotocus* sp. Mean larval densities per square metre ± SE (n = 30) were estimated at 6 ± 3, 4 ± 3, 10 ± 4 and 3 ± 2, respectively. *Pimelopus* larvae were most abundant in areas where live and dead *Meuhlenbeckia* rhizomes and roots were present.

The remains of scarabaeid larvae were recovered from one third (11 of 34 excavated) of the burrows, generally in the upper 20 cm of the burrow. Nine contained *Pimelopus* only, one contained *Scitala sericans* only and both species were located in another. Larvae characteristically had the head and

thorax consumed, the remainder being uneaten (Fig. 5). Since the abdomen of larval scarabs contains mostly semi-digested organic matter and soil particles it may be unpalatable to *Scaraphites*.

Beetles introduced to observation boxes immediately burrowed vertically against an end wall until they reached the bottom. However, during the night beetles moved to the surface and dug oblique burrows which intercepted *Scitala* larvae. Each beetle dug a new burrow every one or two nights. Actual feeding was not observed but after five days all larvae had been partly devoured.

Discussion

Scaraphites rotundipennis appears to be an important predator of scarab larvae where it occurs. The well-developed burrowing ability of the beetles and presumably their larvae, would result in a high searching efficiency. It is likely that the larvae of scarab beetles are an important component in the diet of many burrowing carabids generally. For example, *Barypus clivinoides* Curtis preferentially feeds on scarab larvae in Patagonia (Ahmad & Lloyd, 1972) and a South African *Scarites* sp. can consume at least one, and up to three, large larvae of the dynastine *Heteronychus arator* (F.) per day (Cameron *et al.*, 1979). Like other large carabids (Thiele, 1977) adult *Scaraphites* may live several years and populations are probably of long standing.

In spite of a high consumption of scarab larvae, the low population density, low vagility and probable low fecundity of *Scaraphites rotundipennis* would not seem to favour its use as a biological control agent for root-feeding cockchafers in pastoral situations.

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